

REMARKS

The application has been reviewed in light of the Office Action dated February 8, 2005. Claims 39-51 and 62-64 were pending, with claims 1-38, 52-61 and 65-77 having been canceled previously without disclaimer or prejudice. Claims 45-51 and 62-64 were withdrawn by the USPTO from consideration. By this Amendment, claims 45-51 and 62-64 have been canceled, without disclaimer or prejudice to Applicants' right to pursue the claims in one or more divisional or continuation applications, new claims 78-86 have been added, and claims 39 and 42 have been amended to correct obvious typographical errors therein. Accordingly, claims 39-44 and 78-86 are now pending, with claims 39 and 80 being in independent form.

Claims 39 and 42 were objected to as purportedly having informalities.

By this Amendment, claims 39 and 42 have been amended to correct the typographical errors therein.

Accordingly, withdrawal of the objection to claims 39 and 42 is respectfully requested.

Claims 39, 40 and 42-44 were rejected as purportedly anticipated under 35 U.S.C. §102(b) by or, in the alternative as obvious under 35 U.S.C. §103(a) over, U.S. Patent No. 5,679,152 to Tischler et al. Claim 41 was rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Tischler. Claim 39 was rejected as purportedly anticipated under 35 U.S.C. §102(b) by or, in the alternative as obvious under 35 U.S.C. §103(a) over, U.S. Patent No. 6,294,440 to Tsuda.

Applicants have carefully considered the Examiner's comments and the cited art, and respectfully submit that independent claim 39 is patentable over the cited art, for at least the following reasons.

This application relates to a GaN bulk crystal substrate having low defect density which

renders it suitable for use in connection with, for example, producing a laser diode or light-emitting diode.

For example, independent claim 39 is directed to a bulk crystal substrate of GaN, comprising a slab of GaN single crystal having a substantially uniform composition of GaN in a thickness direction of said slab, and having a defect density lower than about 10^3 cm^{-2} .

Tischler, as understood by Applicants, is directed to a single crystal GaN grown on a sacrificial substrate of SiC or sapphire, with the substrate being etched away after the GaN growth to a desired size.

While Tischler does not disclose the defect density of the single crystal GaN grown according to its technique, it is contended in the Office Action that the disclosures that the single crystal GaN of Tischler is substantially defect free and is a substantially uniform composition equates to a defect density of below 10^3 cm^{-2} or about 10^2 cm^{-2} .

Applicants disagree.

Tischler teaches a technique developed in a background context in which formation of single crystal GaN was extremely difficult. Tischler considers any single crystal GaN to be substantially defect free (see Tischler, col. 1, lines 32-34). It is also noted that Tischler does not present experimental data supporting its claim that the single crystal GaN grown according to the technique described therein is substantially defect free.

Applicants devised improvements to fabrication of bulk crystal substrate of GaN using a melt technique. Applicants compared the GaN crystal produced using the melt technique to GaN crystals grown on a sapphire substrate or SiC substrate. As demonstrated by the cathode luminescent spectra shown in Fig. 5 of the application, a single peak was obtained with the GaN bulk crystal obtained by the melt technique of this application, and in contrast the single crystal

GaN obtained through growth on a SiC or sapphire substrate yielded multiple peaks which evidences a relatively high level of defects as compared to the GaN bulk crystal obtained by Applicants' melt technique.

Applicants maintain that Tischler does not disclose or suggest a bulk crystal substrate of GaN, comprising a slab of GaN single crystal having a substantially uniform composition of GaN in a thickness direction of said slab, and having a defect density lower than about 10^3 cm^{-2} , as provided by the claimed invention of claim 39.

Tsuda, as understood by Applicants, is directed to a method for growing a GaN crystal on a sapphire substrate. In each of the embodiment of Tsuda, the GaN crystal grown according to Tsuda's technique has a thickness less than $10 \mu\text{m}$, and therefore Tsuda does not disclose a bulk crystal substrate as described in claim 39.

In addition, as noted above, Applicants performed experiments comparing GaN crystals produced using Applicants' melt technique to GaN crystals grown on a sapphire substrate, and found that GaN crystals when grown to a bulk crystal size on a sapphire substrate have too great a defect density.

Applicants simply do not find disclosure or suggestion in Tsuda of a bulk crystal substrate of GaN, comprising a slab of GaN single crystal having a substantially uniform composition of GaN in a thickness direction of said slab, and having a defect density lower than about 10^3 cm^{-2} , as provided by the claimed invention of claim 39.

Accordingly, for at least the above-stated reasons, Applicants respectfully submits that independent claim 39 and the claims depending therefrom are patentable over the cited art.

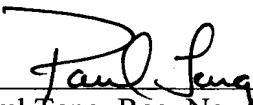
In addition, independent claim 80 and the claims depending therefrom are patentable over the cited art for at least similar reasons.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Office is hereby authorized to charge any fees that may be required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Allowance of this application is respectfully requested.

Respectfully submitted,


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